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(54) **INSTRUMENT FOR OPTICALLY DETECTING TISSUE ATTRIBUTES**

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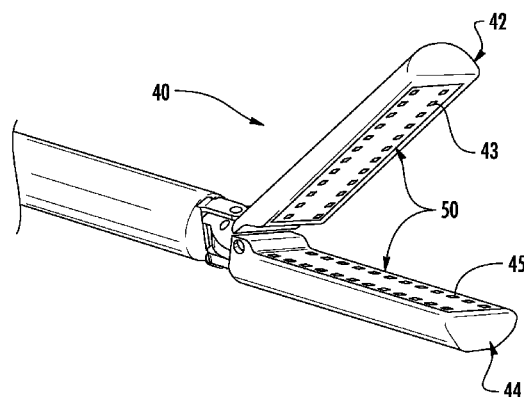*A61B 5/00*   (2006.01)
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See application file for complete search history.

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(57)   **ABSTRACT**

A jaw assembly including first and second jaw members
configured to clamp tissue therebetween. The first jaw mem-
ber includes a surface opposing a surface of the second jaw
member, a light source, and a light detector. The light source
is configured to emit light from an opening defined in the
surface of the first jaw member. The light detector is disposed
within the opening and is configured to sense properties of
light reflected off tissue clamped between the first and second
jaw members and to generate signals indicative of the sensed
properties of light. A processor is operatively associated with
the light detector and is configured to receive the signals from
the light detector. The processor is also configured to analyze
the signals to determine an attribute of tissue clamped
between the first and second jaw members and to provide
feedback to a user of the attribute of the tissue.

21 Claims, 6 Drawing Sheets

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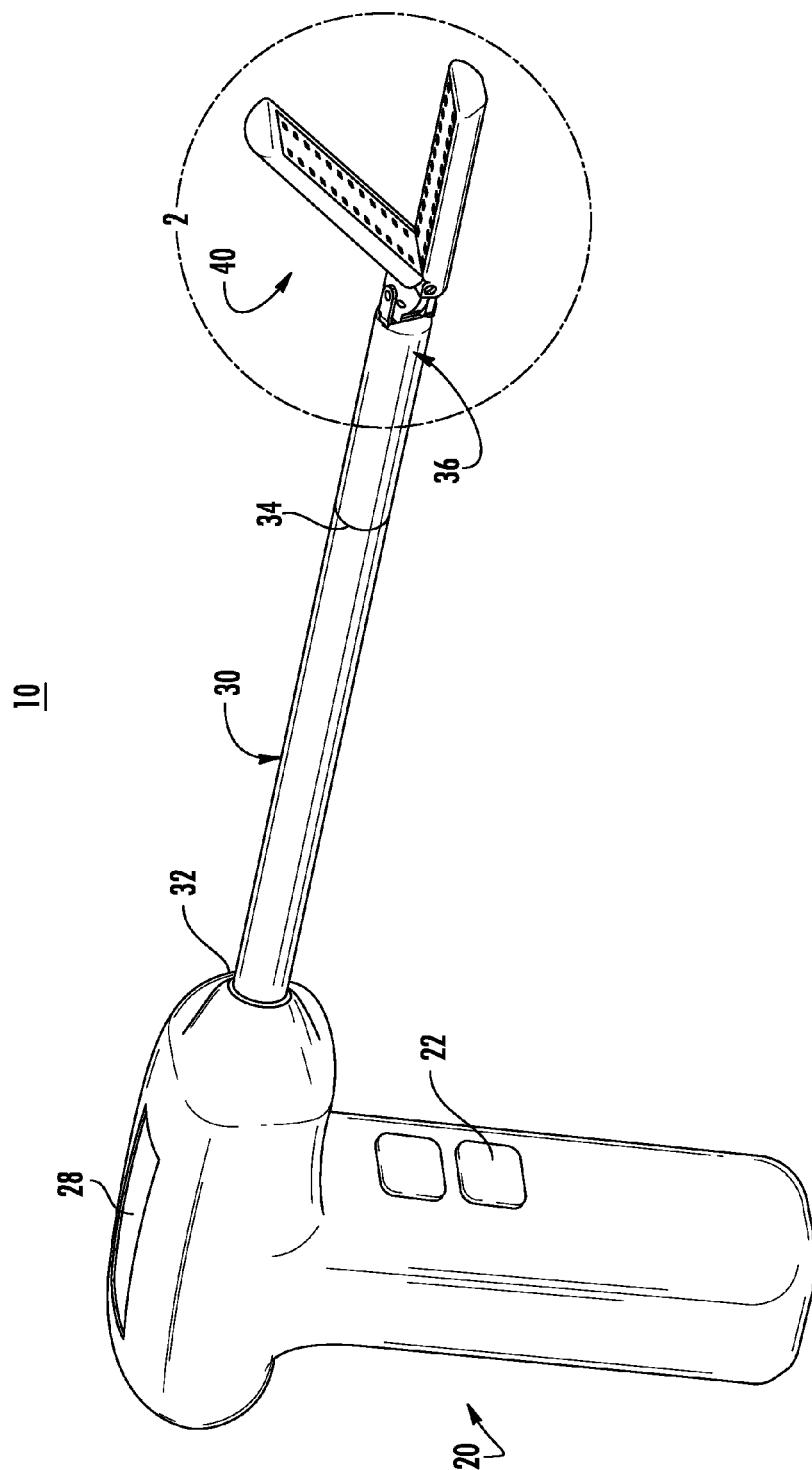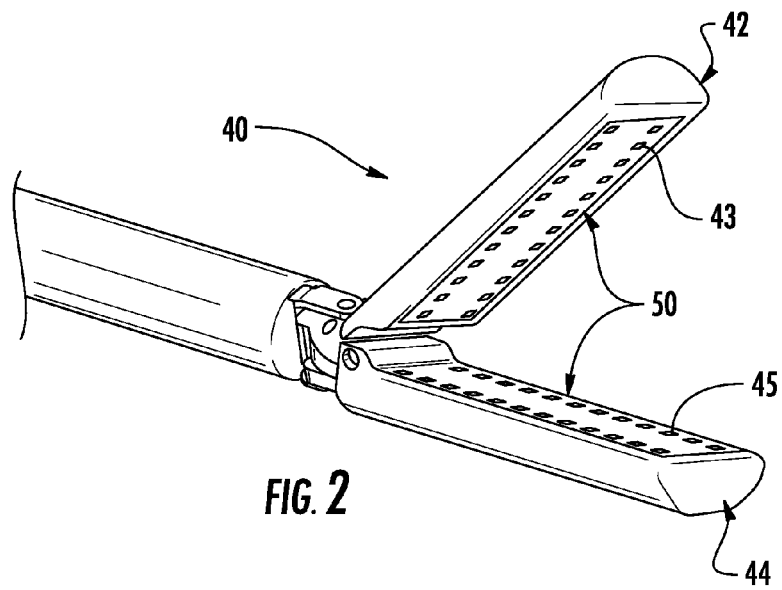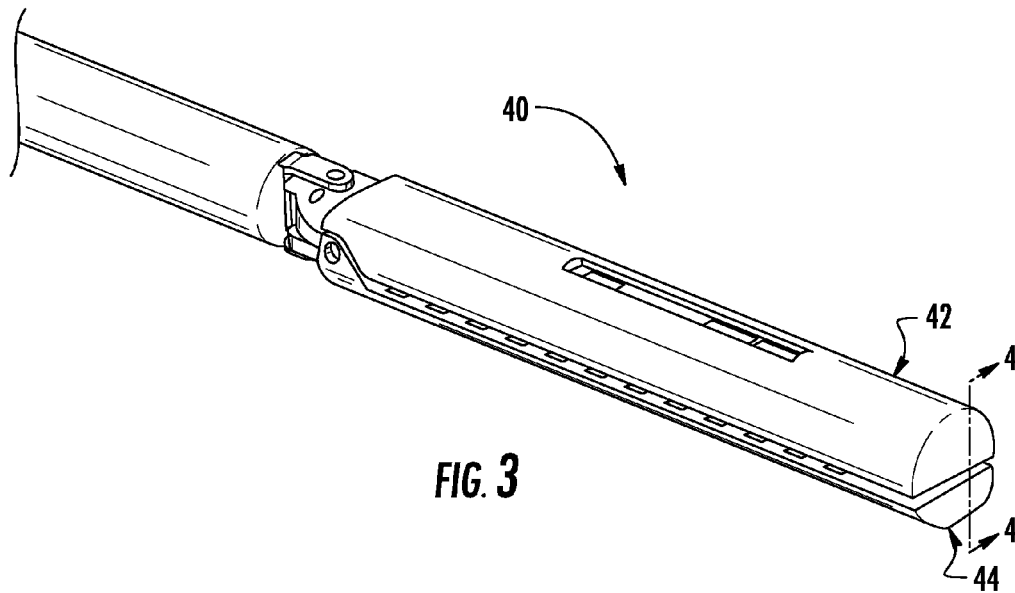European Search Report No. 13189650.8 dated Sep. 10, 2014.

10

2

40

34

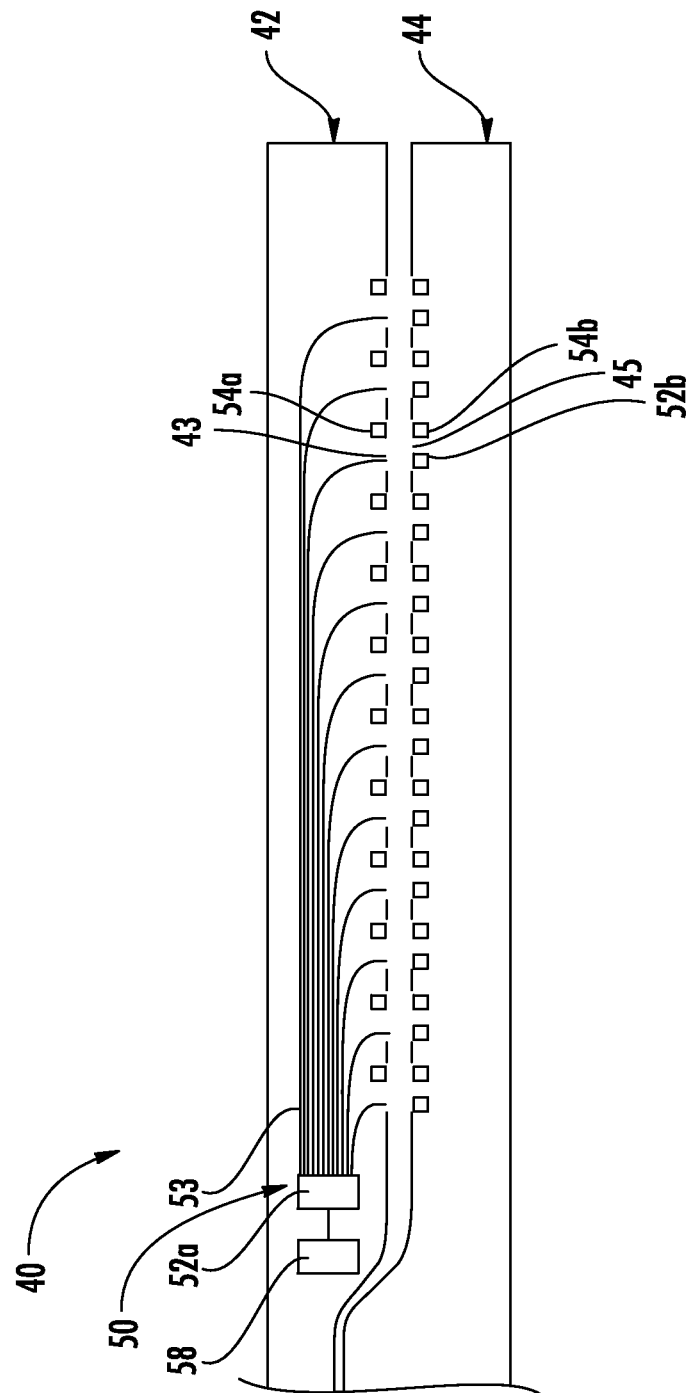30

36

32
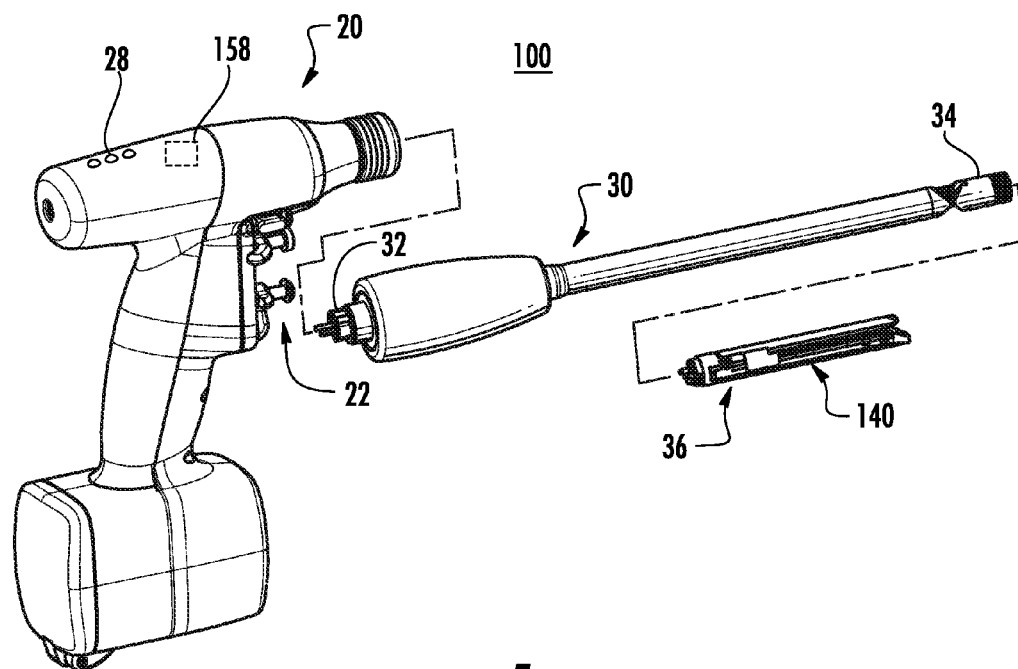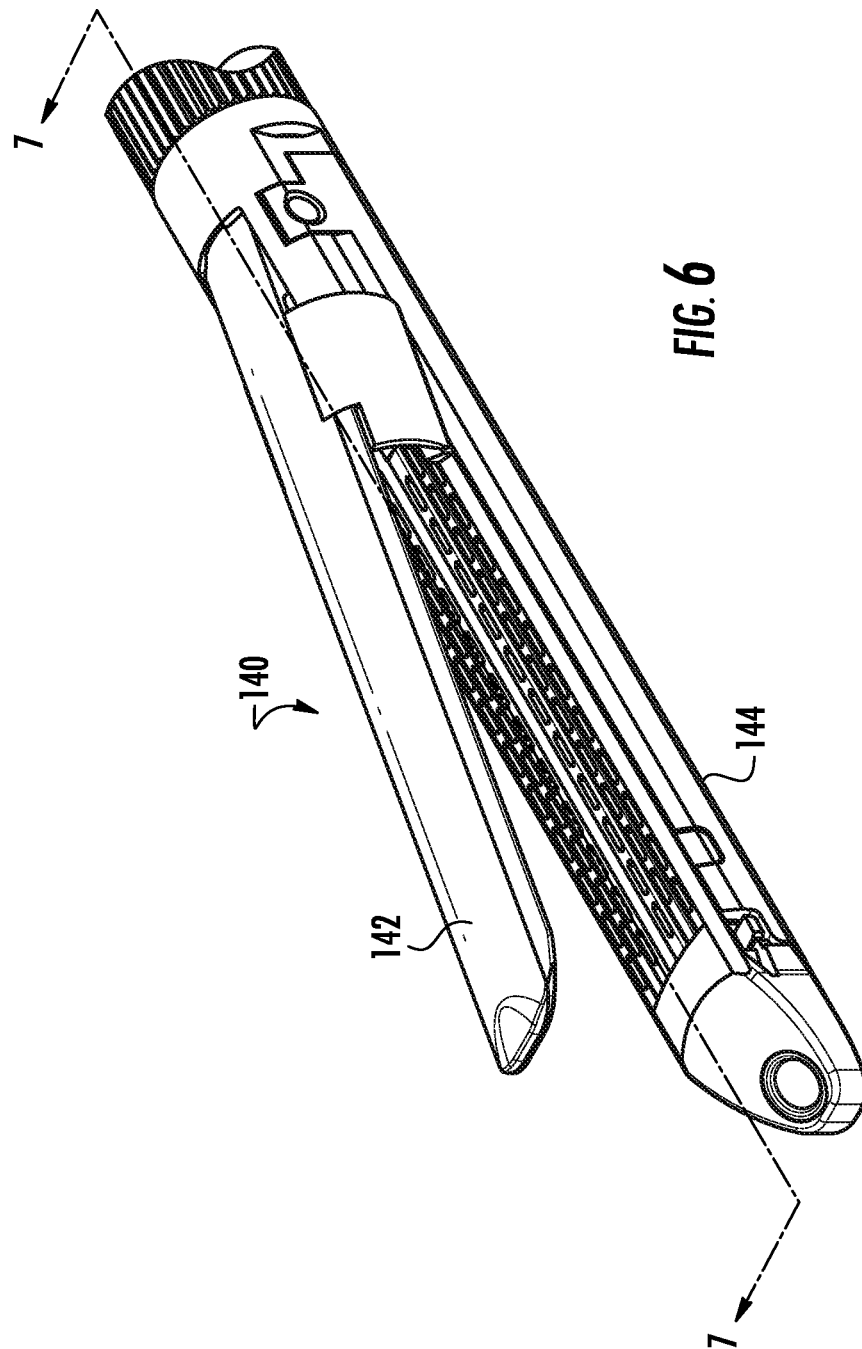
28

22

20

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6
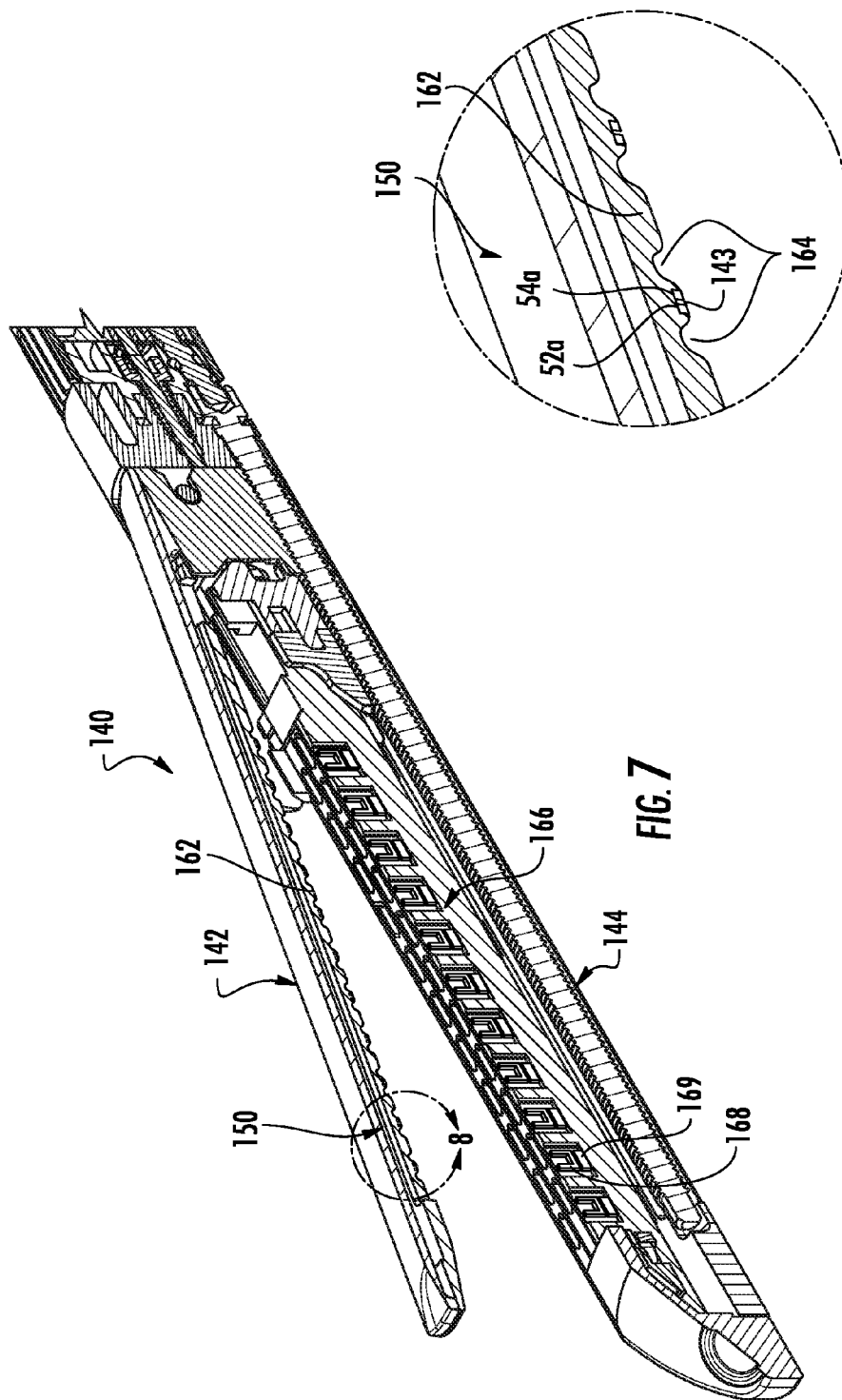
FIG. 7

FIG. 8

INSTRUMENT FOR OPTICALLY DETECTING TISSUE ATTRIBUTES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of and priority to U.S. Provisional Patent Application No. 61/942,937, filed Feb. 21, 2014, the entire disclosure of which is incorporated by reference herein.

BACKGROUND

1. Technical Field

The present disclosure relates to surgical instruments and, more specifically, to a surgical instrument for detecting attributes of tissue with optical technology.

2. Discussion of Related Art

In endoscopic surgical procedures, surgery is performed in any hollow viscus of the body through a small incision or through narrow endoscopic tubes (cannulas) inserted through a small entrance wound in the skin or through a naturally occurring orifice. Endoscopic surgical procedures performed within the interior of the abdomen are referred to as laparoscopic procedures. As used herein both laparoscopic and endoscopic procedures will be collectively referred to as endoscopic procedures. Endoscopic procedures often require the clinician to act on organs, tissues and vessels far removed from the incision

During endoscopic procedures, a surgeon may benefit from knowing attributes of tissue being manipulated to increase the effectiveness of the procedure. For example, knowing the thickness of tissue may aid a surgeon in selecting the proper size staple for the tissue. In addition, identifying the vascular properties within the surgical site the surgeon may identify the red blood cell concentration to determine whether the tissue is diseased or cancerous.

SUMMARY

Accordingly, the present disclosure relates to an endoscopic surgical instrument configured to provide intraoperative feedback of tissue properties within a surgical site.

In an aspect of the present disclosure, a jaw assembly includes first and second jaw members moveable relative to one another between an open configuration and a clamped configuration. In the clamped configuration, the first and second jaw members are configured to clamp tissue therebetween. The first jaw member includes a surface opposing a surface of the second jaw member. The first jaw member further includes an opening defined in the surface of the first jaw member. The first jaw member also includes a light source configured to emit light from the opening and a light detector disposed within the opening. The light detector is configured to sense properties of light reflected off tissue clamped between the first and second jaw members and to generate signals indicative of the sensed properties of light. The jaw assembly further includes a processor operatively associated with the light detector. The processor is configured to receive signals indicative of properties of light from the light detector, to analyze the signals to determine an attribute of tissue clamped between the first and second jaw members, and to provide auditory, haptic, or visual feedback to a user of the attribute of the tissue. The processor may be configured to determine a thickness of tissue clamped between the first and second jaw members. The light source may be configured to generate light by one of electron-stimulation, incandescent

lamps, light emitting diodes, electroluminescence, gas discharge, high-intensity discharge, laser, chemoluminescence, fluorescence, or phosphorescence.

In embodiments, the second jaw member includes a second light detector disposed within a second opening defined in the surface of the second jaw member. The second light detector is configured to sense properties of light transmitted through tissue clamped between the first and second jaw members from the light source of the first jaw member and transmitted and to generate signals indicative of the sensed properties of light. The second light detector may transmit the signals to the processor.

In some embodiments, the second jaw member includes a second light source configured to emit light through a second opening defined in the surface of the second jaw member. The second jaw member further includes a second light detector disposed within the second opening configured to sense properties of light emitted from the second light source and reflected off tissue clamped between the first and second jaw members and to generate signals indicative of the sensed properties of light.

In certain embodiments, the first jaw member includes an anvil and the second jaw member includes a staple cartridge. The staple cartridge includes a plurality of staples configured to be driven through tissue clamped between the first and second jaw members.

In aspects of the present disclosure, a surgical instrument includes a handle, an elongated shaft extending from the handle, and a jaw assembly. The jaw assembly includes first and second jaw members moveable relative to one another between an open configuration and a clamped configuration. In the clamped configuration, the first and second jaw members are configured to clamp tissue therebetween. The first jaw member includes a surface opposing a surface of the second jaw member. The first jaw member further includes an opening defined in the surface of the first jaw member. The first jaw member also includes a light source configured to emit light from the opening and a light detector disposed within the opening. The light detector is configured to sense properties of light reflected off tissue clamped between the first and second jaw members and to generate signals indicative of the sensed properties of light. The jaw assembly further includes a processor operatively associated with the light detector. The processor is configured to receive signals indicative of properties of light from the light detector, to analyze the signals to determine an attribute of tissue clamped between the first and second jaw members, and to provide auditory, haptic, or visual feedback to a user of the attribute of the tissue.

In embodiments, the surgical instrument may include a control interface disposed on the handle that is operatively associated with the jaw assembly. The control interface is configured to actuate the first and second jaw members between the open and clamped configurations. The control interface is operatively associated with the light source to activate the light source to emit light from the opening.

In some embodiments, the surgical instrument includes a display panel disposed on the handle. The display panel operatively associated with the processor and configured to display feedback of the attribute of the tissue.

In certain embodiments, the processor is disposed within the elongated shaft. In other embodiments, the processor is disposed within the handle.

In particular embodiments, one of jaw members includes a staple cartridge having a plurality of staples configured to fire through tissue clamped between the first and second jaw

members. The processor may be configured to control the firing of staples from the surgical instrument.

In some aspects of the present disclosure, a method for detecting tissue attributes includes providing a jaw assembly, clamping tissue between first and second jaw members of the jaw assembly, emitting light from an opening in a surface of the first jaw member, sensing properties of light reflected of the tissue, transmitting signals indicative of properties of light to a processor, determining tissue attributes from the signals with the processor, and providing feedback of the tissue attributes to a user. The first and second jaw members are moveable relative to one another between an open configuration and a clamped configuration. The surface of the first jaw member opposes the second jaw member.

The method may include sensing properties of light transmitted through the tissue clamped between the first and second jaw members of the jaw assembly. The first jaw member including a light source and the second jaw member including a second light detector. Emitting light from the opening may include activating a light source of the first jaw member.

The method may include firing staples from a staple cartridge coupled to one of the first and second jaw members through tissue clamped between the first and second jaw members. Determining tissue attributes may include determining tissue thickness of tissue clamped between the jaw members and the method may include comparing the determined tissue thickness to a predetermined tissue thickness value and preventing additional functions of the surgical instrument when the determined tissue thickness is greater than the predetermined value. The method may further include inputting the predetermined tissue thickness value into a control interface operatively associated with the processor. The method may further include coupling the staple cartridge to one of the first and second jaw members. The staple cartridge may transmit the predetermined value to the processor.

Further, to the extent consistent, any of the aspects described herein may be used in conjunction with any or all of the other aspects described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

Various aspects of the present disclosure are described hereinbelow with reference to the drawings, wherein:

FIG. **1** is a perspective view of a surgical instrument in accordance with the present disclosure including an end effector configured to optically detect properties of tissue;

FIG. **2** is an enlargement of the detail area "**2**" of FIG. **1** showing the jaw members of the surgical instrument of FIG. **1** in an open configuration;

FIG. **3** is a perspective view of the jaw members of FIG. **2** in a clamped configuration;

FIG. **4** is a side cross-sectional view taken along the line **4-4** of FIG. **3**, illustrating the components of a detection assembly;

FIG. **5** is a perspective view of a surgical instrument in accordance with the present disclosure including an end effector configured to optically detect properties of tissue and to fire staples through tissue clamped within the end effector;

FIG. **6** is a perspective view of the jaw members of the end effector shown in FIG. **5**;

FIG. **7** is a side cross-sectional view taken along the line **7-7** of FIG. **6**, illustrating the components of the jaw member assembly; and

FIG. **8** is an enlargement of the detail area "**8**" of FIG. **7** showing a portion of a detection assembly disposed within an opening defined by the upper jaw member.

DETAILED DESCRIPTION

Embodiments of the present disclosure are now described in detail with reference to the drawings in which like reference numerals designate identical or corresponding elements in each of the several views. As used herein, the term "clinician" refers to a doctor, a nurse, or any other care provider and may include support personnel. Throughout this description, the term "proximal" refers to the portion of the device or component thereof that is closest to the clinician and the term "distal" refers to the portion of the device or component thereof that is furthest from the clinician.

Referring to FIG. **1**, a surgical instrument **10** is provided in accordance with the present disclosure including a handle **20**, an elongated shaft **30** extending from the handle **20**, and a jaw assembly **40** coupled to a distal end **34** of the elongated shaft **30**. The handle **20** includes a control interface **22** and a display panel **28**. The control interface **22** is operatively associated with the jaw assembly **40** as detailed below. The display panel **28** is configured to display tissue properties of tissue clamped within the jaw assembly **40** as detailed below.

In alternate embodiments, the display panel **28** is not present on the handle **20** but rather is or functions as a screen remote to the surgical instrument **10** (e.g., a surgical monitor (not shown) inside or outside an operating theater). It is contemplated that the control interface **22** may be integrated into the display panel **28** (e.g., a touch screen display panel whether the display panel **28** is on the handle **20** or remote).

In embodiments, the handle **20** is a powered handle and the control interface **22** includes a plurality of buttons or switches to manipulate the jaw assembly **40**. In some embodiments, the handle **20** is a manual handle and the control interface **22** includes triggers and levers (not shown) to manipulate the jaw assembly **40**. An exemplary example of such a handle is disclosed in commonly owned and co-pending U.S. patent application Ser. No. 13/484,975, filed May 31, 2012, published as U.S. Patent Publication No. 2012/0253329 on Oct. 4, 2012, the contents of which is hereby incorporated by reference in its entirety.

The elongated shaft **30** operatively associates the jaw assembly **40** with the handle **20**. A proximal end **32** of the elongated shaft **30** may be integrally formed with the handle **20**. In embodiments, the proximal end **32** releasably couples the elongated shaft **30** to the handle **20**. In some embodiments, the distal end **34** of the elongated shaft **30** includes a detachable end effector assembly **36** including the jaw assembly **40**. In embodiments, the elongated shaft **30** may rotate relative to the handle **20**. In some embodiments, the jaw assembly **40** articulates relative to the elongated shaft **20**.

With reference to FIGS. **2-4**, the jaw assembly **40** includes an upper jaw member **42**, a lower jaw member **44**, and a detection assembly **50**. The upper jaw member **42** defines a plurality of openings **43** in a surface opposing the lower jaw member **44**. The lower jaw member **44** may define a plurality of openings **45** in a surface **43** opposing the upper jaw member **42**.

The jaw members **42**, **44** are moveable relative to one another between an open configuration (FIG. **2**), wherein the jaw members **42**, **44** are spaced-apart from one another, and a clamped configuration (FIG. **3**), wherein the jaw members **42**, **44** are approximated. The control interface **22** (FIG. **1**) may be used to command a transition of the jaw members **42**, **44** between the open and clamped configurations.

With particular reference to FIG. **4**, the detection assembly **50** is disposed within the jaw assembly **40** and includes light sources **52***a*, **52***b*, light detectors **54***a*, **54***b*, and a processor **58**. The upper jaw member **42** includes a single light source **52***a* and a light detector **54***a* disposed within each opening **43** defined by the upper jaw member **42**. Light from the light source **52***a* is guided to each opening **43** through fiber optic cables or light pipes **53** such that light from light source **52***a* is emitted from each of the openings **43**. It will be appreciated that having the light sources and the light detectors in a single jaw member (e.g., upper jaw member **42**) simplifies the routing of wiring and cables to the light sources and the light detectors. In addition, it will be appreciated that the single jaw member may be fixed relative to the elongated shaft to further simplify the routing of wiring and cables to the light sources and the light detectors.

In embodiments, the lower jaw member **44** includes a plurality of light sources **52***b* and light detectors **54***b* disposed within each opening **45** defined by the lower jaw member **44**. The light sources **52***b* are direct light sources configured to emit light through openings **45**.

The light source **52***a*, **52***b* may generate light by a variety of means including but not limited to electron-stimulation, incandescent lamps, electroluminescent, gas discharge, high-intensity discharge, lasers, chemoluminescence, fluorescence, and/or phosphorescence. It is contemplated that the lower jaw member **44** may include a single light source **52***b* guided through fiber optic cables or light pipes (not shown), to openings **45**, similar to the fiber optic cables or light pipes **53** extending through the upper jaw member **42** to the openings **43**. It is further contemplated that the light source **52***a* may be a plurality of light sources **52***a* disposed within openings **43** of the upper jaw member **42**, similar to light sources **52***b* disposed within the openings **45** of the lower jaw member **44**.

Each light detector **54***a*, **54***b* is operatively associated with the processor **58**. Each light detector **54***a*, **54***b* is a sensor configured to optically sense properties of light contacting the light detector **54***a*, **54***b*. Each light detector **54***a*, **54***b* is operatively associated with the processor **58**. It is contemplated that each light detector **54***a*, **54***b* may be wired directly to or wirelessly connected to the processor **58**. It is within the scope of this disclosure that light detectors **54***a*, **54***b* are tuned to one another to enhance the detection of light attributes. It is also within the scope of this disclosure that each light source, each light pipe, or each a group of light sources or light pipes may be associated with a specific light detector such that the light detector is configured to only detect light from the associated light source, light pipe, or group of light sources or light pipes. Further, it is within the scope of this disclosure that the light sources or light pipes may be operated sequentially to produce a clearer image of the tissue properties.

The wireless connection may be via radio frequency, optical, WIFI, Bluetooth® (an open wireless protocol for exchanging data over short distances (using short length radio waves) from fixed and mobile devices, creating personal area networks (PANs)), ZigBee® (a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for wireless personal area networks (WPANs)), etc.

The processor **58** may be disposed within the surgical instrument **10** (e.g., within the handle **20**, the elongate shaft **30**, or the jaw assembly **40**) or external to the surgical instrument **10**. The processor **58** is configured to receive one or more signal(s) including properties of light from the light detectors **54***a*, **54***b* and is configured to analyze the signal(s) to determine an attribute of tissue clamped between the first and second jaw members. The processor **58** is operatively

associated with the display panel **28** to display the attribute of tissue clamped within the jaw assembly **40** as detailed below.

Each light detector **54***a*, **54***b* may be configured to detect a specific chemical or agent injected into the blood stream of a patient including but not limited to chemicals or agents cable of bioluminescence, radioluminescence, chemoluminescence, fluorescence, and/or phosphorescence. It is contemplated that each light detector **54***a*, **54***b* may be configured to detect the same or different chemicals or agents than each other light detector **54***a*, **54***b*. It is also contemplated that each opening **43**, **45** in a respective one of the jaw members **42**, **44** may include more than one light detector **54***a*, **54***b* with each light detector **54***a*, **54***b* configured to sense a different or the same attribute of light.

With reference to FIGS. **3** and **4**, the detection assembly **50** is used to determine the attributes of tissue clamped within the jaw assembly **40** in accordance with the present disclosure. When tissue is clamped between the upper and lower jaw members **42**, **44** of the jaw assembly **40** one or more of the light sources **52***a*, **52***b* is activated to emit light from respective openings **43**, **45** in the jaw members **42**, **44**. The control assembly **22** (FIG. **1**) may be used to activate the light sources **52***a*, **52***b*. The light emitted from the openings **43**, **45** is reflected off the surface of the tissue clamped within the jaw assembly **40**, backscattering some light back into respective openings **43**, **45** (e.g., light emitted from the light source **52***a* through an opening **43** reflects off the surface of tissue, travels back into the opening **43** and is sensed by the light detector **54***a* disposed within the opening **43**). The light may also be transmitted through the tissue and into an opposing opening **43**, **45** (e.g., light emitted from the light source **52***a* through an opening **43** may be transmitted through the tissue into an opening **45** opposing the opening **43** and sensed by the light detector **54***b* disposed within the opening **45**).

In embodiments, the light sources **52***b* or the end of the fiber optic cables **53**, may be positioned within opening **45** so as to be in direct contact with the surface of tissue to achieve a short photon path length.

The properties of the light sensed by the light detectors **54***a*, **54***b* are converted to electrical signals and transmitted to the processor **58**. The processor **58** analyzes the signals indicative of the properties of the sensed light to determine attributes of the tissue clamped between the jaw members **42**, **44** and displays the tissue attributes on the display panel **28**. For example, the intensity of the light may be used to calculate the thickness of known tissue type (i.e., lung, stomach, intestinal, muscular, etc.) clamped within the jaw assembly **40** and the display panel **28** displays the calculated thickness of the tissue.

In addition, the light detectors **54***a*, **54***b* may be configured to sense properties of light associated with a specific chemical or agent injected into the blood stream of a patient. Further, the light detectors **54***a*, **54***b* may be configured to sense properties of light indicating foreign bodies, diseased tissue, or non-tissue within tissue clamped within the jaw assembly **40**.

In embodiments, the processor **58** may compare the tissue thickness of tissue clamped within the jaw assembly **40** to a predetermined value and provide the clinician with indicia that the tissue thickness is greater than or less than the predetermined value. When the tissue thickness is greater than the predetermined value the processor **58** may provide audible, haptic, or visual indicia to the clinician to alert the clinician that the tissue thickness is greater than the predetermined value (e.g., a red light, a failure tone, a stop icon, an alert light pattern, an audible alert pattern, etc.). When the tissue thickness is less than or equal to the predetermined value, the processor **58** may provide audible, haptic, or visual

indicia to the clinician to alert the clinician that the tissue thickness is less than or equal to the predetermined value (e.g., a green light, a go ahead tone, a go icon, a go light pattern, an audible go pattern, etc.). With a thickness of the tissue determined, a clinician may select an appropriately configured surgical instrument to complete a particular surgical task (e.g., a surgical stapler loaded with an appropriately sized plurality of surgical staples).

Referring to FIGS. **5-8**, a surgical instrument **100** is provided in accordance with the present disclosure including a handle **20**, an elongated shaft **30** extending from the handle **20**, a detachable end effector assembly **36** including a jaw assembly **140**. The jaw assembly **140** includes an upper jaw member **142**, a lower jaw member **144**, and a detection assembly **150**. The upper jaw member **142** includes an anvil **162** having a plurality of staple pockets **164**. The anvil **162** may be releasably coupled to the upper jaw member **142**. An opening **143** is defined in the anvil **162** between each of the staple pockets **164**.

The lower jaw member **144** includes a staple cartridge **166** having a plurality of staples **168** configured to be fired through tissue clamped between the upper and lower jaw members **142**, **144**. Each staple **168** is associated with a staple pusher **169** that is configured to urge the staple **168** from the staple cartridge **166**, through tissue clamped between the jaw members **142**, **144**, and towards the anvil **162**. When each staple **168** contacts the anvil **162**, legs of each staple **168** are formed to secure the staple **168** within the tissue clamped between the jaw members **142**, **144**. The staple cartridge **166** may be releasably coupled to the lower jaw member **144**.

The detection assembly **150** includes a plurality of light sources **52a**, a plurality of light detectors **54a**, and a processor **158**. The light sources **52a** and light detectors **54a** are disposed within the openings **143** defined in the anvil **162** of the upper jaw member **142**. The processor **158** is disposed within the handle **20** and is operatively associated with the light detectors **54a**. The light sources **52a**, the light detectors **54a**, and the processor **158** of surgical instrument **100** operate substantially similar to the light sources **52a**, the light detectors **54a**, and the processor **58** of surgical instrument **10** detailed above, as such only the differences are detailed below.

The processor **158** may be configured to lock out additional functions of the jaw assembly **140** when the tissue thickness of tissue clamped within the jaw assembly **140** is greater than a predetermined value (e.g., prevents the staples **168** from firing from the staple cartridge **166**).

The clinician may input the predetermined value into a control assembly **22**. The control assembly **22** may be disposed on the handle **20** or remote to the surgical instrument **100**. The staple cartridge **166** may be replaceable with a plurality of staple cartridges having varying sized staples **168**. The size of the staples **168** within the staple cartridge **166** coupled to the lower jaw member **144** may determine the predetermined value. The staple cartridge **166** may be operatively associated with the processor **158** such that when the staple cartridge **166** is coupled to the lower jaw member **144** the predetermined value associated with the staple cartridge **166** is transmitted to the processor **158**. It is also contemplated that the predetermined value includes an upper limit and a lower limit associated with a suitable thicknesses of tissue for the staple cartridge **166** and the processor **158** is configured to prevent the staples **168** from firing if the tissue thickness is not between the upper and lower limits.

The tissue thickness may be determined by the red blood cell density within the tissue. For example, if there is too much blood occlusion the reduced density of the red blood

cells indicates that the staples **168** within the staple cartridge **166** are too small for the tissue clamped within the jaw assembly **140**.

The attributes of tissue clamped within the jaw member assembly **40**, **140** may also be detected by detecting abnormal blood flow. For example, abnormal blood flow may indicate that cancerous or tumorous tissue is clamped within the jaw assembly **40**, **140** informing the clinician that a resection margin (i.e., the amount of tissue being removed containing cancerous or tumorous tissue) should be increased.

As mentioned above, the detection assembly **50** may be provided as a standalone instrument or as part of a multifunction surgical instrument including but not limited to a surgical stapler, a grasper, or an electrosurgical device.

The various embodiments disclosed herein may also be configured to work with robotic surgical systems and what is commonly referred to as "Telesurgery". Such systems employ various robotic elements to assist the surgeon in the operating theatre and allow remote operation (or partial remote operation) of surgical instrumentation. Various robotic arms, gears, cams, pulleys, electric and mechanical motors, etc. may be employed for this purpose and may be designed with a robotic surgical system to assist the surgeon during the course of an operation or treatment. Such robotic systems may include, remotely steerable systems, automatically flexible surgical systems, remotely flexible surgical systems, remotely articulating surgical systems, wireless surgical systems, modular or selectively configurable remotely operated surgical systems, etc.

The robotic surgical systems may be employed with one or more consoles that are next to the operating theater or located in a remote location. In this instance, one team of surgeons or nurses may prep the patient for surgery and configure the robotic surgical system with one or more of the instruments disclosed herein (e.g., the jaw assembly **40**) while another surgeon (or group of surgeons) remotely control the instruments via the robotic surgical system. As can be appreciated, a highly skilled surgeon may perform multiple operations in multiple locations without leaving his/her remote console which can be both economically advantageous and a benefit to the patient or a series of patients.

The robotic arms of the surgical system are typically coupled to a pair of master handles by a controller. The handles can be moved by the surgeon to produce a corresponding movement of the working ends of any type of surgical instrument (e.g., end effectors, graspers, knifes, scissors, etc.) which may complement the use of one or more of the embodiments described herein. The movement of the master handles may be scaled so that the working ends have a corresponding movement that is different, smaller or larger, than the movement performed by the operating hands of the surgeon. The scale factor or gearing ratio may be adjustable so that the operator can control the resolution of the working ends of the surgical instrument(s).

The master handles may include various sensors to provide feedback to the surgeon relating to various tissue parameters or conditions (e.g., tissue resistance due to manipulation, cutting or otherwise treating, pressure by the instrument onto the tissue, tissue temperature, tissue impedance, etc.). As can be appreciated, such sensors provide the surgeon with enhanced tactile feedback simulating actual operating conditions. The master handles may also include a variety of different actuators for delicate tissue manipulation or treatment further enhancing the surgeon's ability to mimic actual operating conditions.

While several embodiments of the disclosure have been shown in the drawings, it is not intended that the disclosure be

limited thereto, as it is intended that the disclosure be as broad in scope as the art will allow and that the specification be read likewise. Any combination of the above embodiments is also envisioned and is within the scope of the appended claims. Therefore, the above description should not be construed as limiting, but merely as exemplifications of particular embodiments. Those skilled in the art will envision other modifications within the scope and spirit of the claims appended hereto.

What is claimed:

1. A jaw assembly comprising:

first and second jaw members moveable relative to one another between an open configuration and a clamped configuration, the first and second jaw members configured to clamp tissue therebetween in the clamped configuration, the first jaw member including:

a surface opposing a surface of the second jaw member;

an opening defined in the surface of the first jaw member;

a light source configured to emit light from the opening; and

a light detector disposed within the opening, the light detector configured to sense properties of light reflected off tissue clamped between the first and second jaw members and to generate signals indicative of the sensed properties of light; and

a processor operatively associated with the light detector, the processor configured to:

receive signals indicative of properties of light from the light detector;

analyze the signals to determine an attribute of tissue clamped between the first and second jaw members; and

provide feedback to a user of the attribute of tissue clamped between the first and second jaw member.

2. The jaw assembly of claim 1, wherein the feedback is at least one of auditory, haptic, or visual.

3. The jaw assembly of claim 1, wherein the processor is configured to determine a thickness of tissue clamped between the first and second jaw members.

4. The jaw assembly of claim 1, wherein the second jaw member includes a second light detector disposed within a second opening defined in the surface of the second jaw member, the second light detector configured to sense properties of light emitted from the light source of the first jaw member and transmitted through tissue clamped between the first and second jaw members, the second light detector operatively associated with the processor.

5. The jaw assembly of claim 1, wherein the second jaw member includes a second light source configured to emit light through a second opening defined in the surface of the second jaw member and includes a second light detector disposed within the second opening, the second light detector configured to sense properties of light emitted from the second light source and reflected off tissue clamped between the first and second jaw members.

6. The jaw assembly of claim 1, wherein the light source is configured to generate light from at least one of electron-stimulation, incandescent lamps, light emitting diodes, electroluminescence, gas discharge, high-intensity discharge, laser, chemoluminescence, fluorescence, or phosphorescence.

7. The jaw assembly of claim 1, wherein the first jaw member includes an anvil and the second jaw member includes a staple cartridge having a plurality of staples configured to be driven through tissue clamped between the first and second jaw members.

8. A surgical instrument comprising:

a handle;

an elongated shaft extending from the handle; and

a jaw assembly coupled to a distal end of the elongated shaft, the jaw assembly including first and second jaw members moveable relative to one another between an open configuration and a clamped configuration, the first and second jaw members configured to clamp tissue therebetween in the clamped configuration, the first jaw member including:

a surface opposing a surface of the second jaw member;

an opening defined in the surface of the first jaw member;

a light source configured to emit light from the opening; and

a light detector disposed within the opening, the light detector configured to sense properties of light reflected off tissue clamped between the first and second jaw members and to generate signals indicative of the sensed properties of light; and

a processor operatively associated with the light detector, the processor configured to:

receive signals indicative of properties of light from the light detector;

analyze the signals to determine an attribute of tissue clamped between the first and second jaw members; and

provide feedback to a user of the attribute of the tissue clamped between the first and second jaw member.

9. The surgical instrument of claim 8 further including a control interface disposed on the handle, the control interface operatively associated with the jaw assembly and configured to actuate a transition of the first and second jaw members between the open and clamped configurations, the control interface operatively associated with the light source and configured to activate the light source to emit light from the opening.

10. The surgical instrument of claim 8 further including a display panel disposed on the handle, the display panel operatively associated with the processor and configured to display feedback of the attribute of the tissue.

11. The surgical instrument of claim 8, wherein the processor is disposed within the elongated shaft.

12. The surgical instrument of claim 8, wherein the processor is disposed within the handle.

13. The surgical instrument of claim 8, wherein one of the first and second jaw members includes a staple cartridge, the staple cartridge including a plurality of staples configured to fire through tissue clamped between the first and second jaw members.

14. The surgical instrument of claim 13, wherein the processor is configured to control the firing of staples from the surgical instrument.

15. A method for detecting tissue attributes comprising:

providing a jaw assembly including first and second jaw members moveable relative to one another between an open configuration and a clamped configuration;

clamping tissue between the first and second jaw members of the jaw assembly;

emitting light from an opening in a surface of the first jaw member;

sensing properties of light reflected off the tissue clamped within the jaw assembly into the opening with a light detector positioned within the opening;

transmitting signals indicative of the properties of light to a processor;

determining tissue attributes from the signals with the processor; and

providing feedback of the tissue attributes to a user.

16. The method of claim **15** further comprising sensing properties of light transmitted through the tissue clamped between the first and second jaw member of the jaw assembly, the first jaw member including a light source and the second jaw member including a second light detector.

17. The method of claim **15**, wherein emitting light from the opening includes activating a light source of the first jaw member.

18. The method of claim **15** further comprising firing staples from a staple cartridge coupled to one of the first and second jaw members through tissue clamped between the first and second jaw members.

19. The method of claim **18**, wherein determining tissue attributes comprises determining tissue thickness and the method further includes:

comparing the determined tissue thickness to a predetermined tissue thickness value; and

preventing additional functions of the surgical instrument when the tissue thickness is greater than the predetermined value.

20. The method of claim **19** further comprising inputting the predetermined tissue thickness value into a control interface operatively associated with the processor.

21. The method of claim **19** further comprising coupling the staple cartridge to one of the first and second jaw members, the staple cartridge transmitting the predetermined value to the processor.

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